IN THE UNITED STATES PATENT AND TRADEMARK OFFICE
BEFORE THE BOARD OF PATENT APPEALS AND INTERFERENCES

Appellant:	Edward L. Gibbs	)		
		)		
Serial No.:	10/666,105	)	Art Unit:	1725
		)		
Filed:	September 18, 2003	)	Examiner:	Kerns
		)		
For:	PANEL ASSEMBLY APPARATUS	)		

APPELLANT'S BRIEF

Gary Peterson, Reg. No. 28,891
211 N. Robinson Ave., Suite 450 South
Oklahoma City, Oklahoma 73102
(405) 606-3367

Attorney for Appellant

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I. REAL PARTIES IN INTEREST.

A real party in interest, in addition to the named Appellant, is Ameristar Fence Products, Inc., of Tulsa, Oklahoma. Two additional co-inventors, Fred L. Givens, of Tulsa, Oklahoma, and Gary W. Vonnahme, of Broken Arrow, Oklahoma, are named in a pending request to correct inventorship.

II. RELATED APPEALS AND INTERFERENCES.

None.

III. STATUS OF CLAIMS.

Claims 15-34 are under appeal.

IV. STATUS OF AMENDMENTS.

No amendments after final rejection have been filed.

V. SUMMARY OF CLAIMED SUBJECT MATTER.

The Appellant, Edward L. Gibbs, is the founder of Ameristar Fence Products, Inc., a manufacturer of ornamental fencing in Tulsa, Oklahoma.

The Appellant and his coinventors, Fred L. Givens and Gary W. Vonnahme,[1] have conceived of a fencing panel, best shown in Figures 4-6, in which conductive pickets 12 extend through openings 34 formed in the top surface of one or more channel-shaped conductive rails 10. The pickets 12 are secured to the side walls of each rail 10 by welds 36 formed within the rail channel, as shown in Figure 6. Each

[1]Mr. Givens and Mr. Vonnahme are named as coinventors with the Appellant in a pending request to correct inventorship. The Examiner imposed a correction requirement with regard to the request, which the Applicant complied with. As of this writing, no action had been taken by the Examiner on the corrected request.

of these welds 36 is formed by a resistance welding process at a projection 28, best shown in Figures 1 and 2, which is formed at the point of contact between the side wall of the rail 10 and the picket 12.

The Appellant's fencing panel has several advantages. In many prior art welded fencing systems, welds between a picket and a rail had to be formed at an external surface of the rail. Such external welds leave visible blemishes on the rail surface which detract from the ornamental character of the fencing panel. In contrast, welds in the Appellant's panel do not interfere with the panel's ornamental effect, because these welds are formed in an internal region of the rail, and thus are not visible to the ordinary observer.

A second advantage of the Appellant's panel is that, unlike many prior art systems, there is no need for welding of any panel components by hand. The design is thus well-adapted for mass production techniques, which are capable of producing fencing panels at considerably lower cost than is possible with traditional hand assembly techniques. The invention claimed in the instant application is directed to a welding apparatus adapted to produce the Appellant's welded fencing panel.

The claimed welding apparatus is best shown in Figures 9, 11 and 12. The apparatus comprises a welding area 78 in which a flat panel framework 14 is horizontally positionable at a first welding position. The panel framework 14 has opposed first and second sides 16 and 18. Each side has plural planar conductive surfaces.

A first welding station 100 is situated in a first row 84 within the welding area 78 and positionable in contact with the first side 16 of a panel framework 10 in the first welding position, as shown in Figure 9 and on the left had side of Figure 11. As best shown in Figure 11, the first welding station 100 comprises adjacent first electrode 104 and a second electrode 108, of opposed polarity. Each of the electrodes 104 and 106 has a planar contact surface adapted to contact a planar conductive surface of the first side 16.

A second welding station 102 is situated within the welding area 78 in a second row 86 that is longitudinally spaced from the first row 84, as shown in Figure 9 and on the left had side of Figure 12. The second welding station 102 is positionable in contact with the second side 18 of a panel framework 10 in the first welding position. As shown in Figure 12, the second welding station 102 comprises adjacent electrodes of opposed polarity.

As shown in Figure 9, the electrodes of the first welding station 100 are positionable to weld picket 46 to an upper rail of the panel framework 14 at its first side 16, while spaced electrodes of the longitudinally offset second welding station 102 are positionable to weld adjacent picket 48 to the same upper rail at the opposed second side 18 of the panel framework 14. The first and second electrode assemblies are adapted to weld the pickets 12 to one or more upper rails 40 and 42, best shown in Figure 10, and may be capable of welding simultaneously.

The invention under appeal further comprises a conveyor 66, best shown in Figures 8A and 8B, which is capable of moving the panel framework 14 horizontally

within the welding area 78 from a first welding position to a longitudinally offset second welding position. Once the panel framework 14 has been moved by conveyor 66 from the first to the second welding position, another pair of adjacent pickets may be welded by the first and second welding stations at opposite sides of the panel framework 14. By advancing the panel framework to successive welding positions, this process may be repeated until all pickets 12 of the panel framework 14 have been welded to rails 10.

The invention under appeal further comprises a third welding station, shown in the right hand side of Figure 11, situated in the first row 84 within the welding area 78 and positionable adjacent the first side 16 of a panel framework 14 in the first welding position. The third welding station comprises an electrode assembly 124 formed from adjacent electrodes 128 and 130 of opposed polarity.

The invention under appeal further comprises a fourth welding station, shown on the right hand side of Figure 12, situated in the second 86 row within the welding area 78 and positionable adjacent the second side 18 of a panel framework in the first welding position. The fourth welding station comprises and electrode assembly 126 formed from adjacent electrodes of opposed polarity. The third and fourth electrode assemblies are adapted to weld the pickets 12 to a lower rail 44, best shown in Figure 10.

The invention under appeal may further comprise a panel framework 14 situated within the welding area 78. The panel framework 14 is characterized by at least one channel-shaped first rail 40 having a plurality of longitudinally spaced

openings 34 therein, and a plurality of longitudinally spaced upright members 12, each upright member extending in transverse relationship to the at least one first rail 12, through the rail channel thereof, and through a corresponding opening 34 therein. The panel framework 14 may further comprise a second channel-shaped rail 42, disposed in laterally spaced parallel relationship to the first rail 40. Each upright member 12 extends in transverse relationship to the second 42 rail, and within the rail channel thereof.

In the invention under appeal, the rail 10 of the panel framework 14, best shown in Figure 1, may include a web 20 with spaced side walls 22 and 24 extending therefrom. At least one of the side walls is characterized by a weld-forming 28 region which projects within the rail channel 26.

The width of the first electrode 104 may be least about 75% of the width of the first rail 40, and the width of the second electrode 108 may be at least about 75% of the width of an upright member 46, as shown in Figure 16. The center-to-center separation of the first and second electrodes 104 and 108 may be between about 2 and about 3 inches.

VI. GROUNDS OF REJECTION UNDER APPEAL.

1. Claims 15-34 were rejected for obviousness under 35 U.S.C. § 103 based on the Senn and Ahn patents.

VII. ARGUMENT.

The Examiner rejected claims 15-34 under 35 U.S.C. § 103 as unpatentably obvious over U.S. Patent No. 4,174,475, issued to Senn, in view of U.S. Patent No. 5,403,985, issued to Ahn. We disagree with these rejections.

A. The Senn Patent.

The Senn '475 patent discloses a machine used to form a 2-dimensional reinforcing mesh, of the type used in airport concrete. See Senn '475, column 2, lines 17-19. A row of 32 welding guns 120 is used to weld cross rods 18 to longitudinal rods 16. See Senn '475, Figure 2. Upper electrodes 124 contact the rods from above, while stationary lower electrodes 132 contact the rods from below. Current flows from the upper to the lower electrode 132 across a rod 16. Current then flows from lower electrode 132 to adjacent lower electrode 132, then across adjacent rod 16 to adjacent upper electrode 124 to complete the circuit. See Senn '475, column 3, line 64 - column 4, line 3. The current flow is illustrated in somewhat greater detail in Figure 3A of Senn's U.S. Patent No. 3,780,253 and its accompanying description at column 3, lines 52-67. See Evidence Appendix. Senn '253 patent is expressly referenced in the cited Senn '475 patent as providing a fuller description of the current flow in the Senn '475 system. See Senn '475, column 4, lines 6-8.

Current will flow between the upper and lower electrodes in the Senn system, as required to produce welds, only if these two electrodes have opposite polarities. These upper and lower electrodes contact opposite sides of the Senn mesh 12. In contrast, the Appellant's claim 15 specifies that the first and second electrodes of the

first welding station **each** have a planar contact surface "adapted to contact a planar conductive surface of the first side." Even if the Senn mesh had planar conductive surfaces, only the upper electrode 124 in the Senn system contacts the first side (i.e., upper side) of Senn's mesh. The lower electrode 132, which has the opposite polarity required by claim 15, only contacts the second side (*i.e.*, lower side) of the mesh. In short, Senn '475 lacks a welding station with two electrodes of opposite polarities, both of which are "adapted to contact a planar conductive surface of the first side" of the mesh 12, as required by independent claim 15. The Examiner acknowledged this deficiency in the first paragraph of page 5 of the Action mailed April 17, 2006.

B. The Ahn Patent.

The Ahn patent discloses a welder used to form a 3-dimensional panel 10 from two spaced and parallel 2-dimensional wire meshes 18 and 24, which are sandwiched around a layer of insulation 12. The 2-dimensional upper wire mesh 18 is formed from longitudinal and lateral wires 14 and 16, as is the lower wire mesh 24. The 2-dimensional longitudinal and lateral wires that form meshes 18 and 24 are **not** welded together during operation of Ahn's system. Instead, the wire meshes 18 and 24 are pre-assembled, presumably by a welding process like that disclosed by Senn.

The Ahn system features feeders 36 and 38 that plunge wire supporting members 26 and 28 through the insulation layer 12, such that the each supporting member 26 and 28 contacts a longitudinal wire in the lower mesh 18 at its lower end, and a longitudinal wire in the upper mesh 24 at its upper end, as shown in Ahn's Figure 2. Upper and lower welding mechanisms 42 and 44 then respectively weld the

upper mesh 18 and the lower mesh 24 to each support member 26 and 28. The Ahn system thus produces a 3-dimensional panel structure from a pair of pre-welded 2-dimensional planar meshes.

As Ahn's Figure 10 illustrates, each welding mechanism 42 and 44 features a pair of positive and negative electrodes 200 and 202 which are situated on the same side of the panel framework. As may be seen by comparing the left and right sides of Figure 10, the planar contact surfaces of the electrodes 202 and 204 are disposed in orthogonal relationship to the planes defining the meshes 18 and 24. This electrode orientation is essential to form an effective welding contact between the electrodes and the transversely oriented support members 26 and 28. The electrodes move laterally to enclose a support member 26 or 28 at its junction with the longitudinal wire of the upper or lower mesh, and form a weld therebetween.

In the Applicant's apparatus, as Figures 14-16 illustrate, the planar contact surfaces of the first and second electrodes 104 and 108 extend in parallel relationship to the planar sides of the panel framework 14, rather than in orthogonal relationship thereto, as in the Ahn patent. The Applicant's transverse axial positioning of the electrodes 104 and 108 adapts each electrode "to contact a planar conductive surface of the first side" of the panel framework, as required by claim 15. Specifically, the first electrode 104 contacts a planar side wall of rail 40, while second electrode 108 contacts a planar side surface of upright member 46.

The planar surfaces of the Ahn electrodes are not "adapted to contact a planar surface" in the first side of panel 10, as the Appellant's claim 15 requires. Instead, the

planar surfaces of the Ahn electrodes are adapted to enclose a non-planar wire supporting member 26 or 28 at its junction with a longitudinal wire 14. Even if the Ahn panel included any planar conductive surface on the first side of panel 10, it would be impossible for that surface to contact the planar surfaces of either of Ahn's closely spaced coaxial electrodes 200 and 202.

C. Independent Claim 15, and its Dependent Claims, Would Not Have Been Obvious In View of the Senn and Ahn Patents.

In rejecting independent claim 15 as obvious, the Examiner asserted that it would have been obvious to modify Senn's welding structure, in which electrodes of opposite polarity are positionable on opposite sides of a panel framework, by using adjacent electrodes of opposite polarity positionable on the same side of a panel framework, as taught by Ahn. According to the Examiner, the reason an artisan would make such a design change in Senn's system would be "to obtain three-dimensional construction panels that are assembled and spot welded simultaneously ... thus reducing construction time." Action mailed April 17, 2006, at 5. We disagree that such design changes would have been obvious.

As noted above, the Senn system is used to form 2-dimensional wire meshes, while the Ahn system is used to form 3-dimensional panels from 2-dimensional wire meshes. In other words, the Ahn system needs the output of the Senn system in order to function successfully. If an artisan familiar with the Ahn and Senn references desired to produce a 3-dimensional construction panel, as the Examiner has suggested, he or she would merely take the 2-dimensional wire meshes outputted by the Senn

system, and input them into the Ahn system to produce 3-dimensional panels. There would be no reason whatever for modifying either reference, since each performs a key step in a multi-stage manufacturing process.

Contrary to the Examiner's assertion, it would not be possible to combine Senn and Ahn into any kind of practical device capable of **simultaneously** producing the 2-dimensional grids of welds needed to form wire meshes and the 3-dimensional welds needed join support members 26 and 28 to each wire mesh. The Examiner has suggested that an artisan might replace Senn's electrode pairs, which are situated on opposite sides of the panel framework, with Ahn's electrode pairs, which are situated on the same side of the panel. If this were done, Ahn's electrodes 200 and 202 might be able to form the welds between support members 26, 28 and the longitudinal wires 14, 20. But the orientation of the Ahn electrodes 200 and 202 would make them incapable of welding the longitudinal wires 14, 20 to the lateral wires 16, 22.

Without some way of welding the lateral and longitudinal wires together to form a mesh, it would be impossible for the modified device suggested by the Examiner to produce a functional 3-dimensional panel. When the panel framework is removed from the welding station, the unwelded upper lateral 16 wires 18 will simply roll away, and the unwelded lower lateral wires 20 will drop to the ground. It would not be possible to weld at the same position with both the Senn and Ahn welders: as Senn Figure and Ahn Figure 10 illustrate, there would be insufficient room to incorporate both types of welders into the same system.

In order for a combination of references to render a claimed invention obvious, the combination must **both** meet the claimed structure "and at the same time result in a practical, operative mechanism." See *In re Donovan*, 184 USPQ 414, 420 (CCPA 1975). The combination of Senn and Ahn proposed by the Examiner would be neither practical nor operative. One skilled in the art would have used the Senn and Ahn devices in series, rather than attempting to combine their features so as to produce an inoperative system. Because neither Senn nor Ahn meets the requirements of claim 15, and because it would not have been obvious to combine these devices into a single system, claim 15 is allowable over these references.

Claims 16-25 depend from claim 15, directly or indirectly, and include all of its limitations. These dependent claims are allowable over the cited references, at a minimum, for the same reasons discussed with regard to claim 15.

D. Claims 19, and the Claims Dependent Therefrom, Are Allowable Over the Senn and Ahn Patents.

Claim 19 further defines the apparatus as including a panel framework situated within the welding area. The claimed panel framework is characterized by at least one channel-shaped first rail having a plurality of longitudinally spaced openings therein. A plurality of longitudinally spaced upright members extend in transverse relationship to the at least one first rail, through the rail channel thereof, and through a corresponding opening in the rail.

Neither Senn nor Ahn disclose or suggest the positioning within the welding area of a panel framework having the claimed characteristics: Senn discloses only a

2-dimensional steel mesh used in airport concrete, while Ahn discloses only an insulated panel sandwiched between two spaced-apart steel meshes. In his rejection, the Examiner cited nothing in these references, and nothing from any other source, to support an obviousness rejection of claim 19. Instead, the Examiner contended that the claimed panel framework element was merely a "recitation of the intended use of the invention" and "directed to a manner of operating the welding apparatus." According to the Examiner, he is free to ignore such limitations in applying prior art references. Action mailed April 17, 2006 at 4. We disagree.

Claim 19 says nothing about any intended use of an apparatus. Instead, the claim positively sets out an additional structural component, a panel framework, that cooperates with the structural components set out in claim 15. The claim further positively sets out structural components of this additional structure, including a channel-shaped rail and plurality of transversely disposed upright members. The device defined in claim 19 is a functioning apparatus, and it is a different apparatus than the one defined in claim 15. In refusing to give effect to the structural limitations set out in claim 19, the Examiner has effectively denied the Appellant his statutory right to claim what he "regards as his invention," guaranteed 35 U.S.C. § 112, second paragraph.

When the structural elements set out in claim 19 are given effect, as the law requires, there is no evidence of record that would support the rejection of claim 19 on grounds of obviousness. That rejection accordingly cannot stand.

Claims 20-25 depend from claim 19, directly or indirectly, and include all of the limitations of claim 19. These claims specify further structural details of the panel framework component introduced in claim 19. These dependent claims are allowable, at a minimum, for the same reasons discussed with regard to claim 19.

E. Claim 26, and the Claims Dependent Therefrom, Are Allowable Over the Senn and Ahn Patents.

Claim 26 is phrased similarly to claim 15, but omits the second welding station. Thus, just like claim 15, claim 26 requires that the first and second electrodes of the first welding station each have a planar contact surface "adapted to contact a planar conductive surface of the first side." Thus, the Senn reference, in which electrodes of opposite polarities are positionable only on opposite sides of a panel framework, fails to meet the limitations of claim 26. Likewise, the paired electrodes 200 and 202 of the Ahn reference, which are not "adapted to contact a planar surface" in the first side of the Ahn panel 10, fail to meet claim 26. Claim 26 is thus allowable over the Senn and Ahn references for substantially the same reasons discussed with regard to claim 15.

Claim 26 also includes the same limitations introduced in claim 19, requiring a panel framework situated within the welding area. The panel framework includes at least one channel-shaped first rail having a plurality of longitudinally spaced openings therein, and a plurality of longitudinally spaced upright members. Each upright member extends in transverse relationship to the at least one first rail, through the rail channel thereof, and through a corresponding opening therein. None of the cited references discloses a panel framework having the claimed characteristics,

nor has the Examiner come forward with any reason why an artisan would place such a structure either in Senn's wire mesh manufacturing machine, or in Ahn's insulated panel manufacturing machine. Claim 26 is accordingly unobvious in view of the Senn and Ahn references, for the same reasons discussed with regard to claim 19.

Claims 27-34 depend from claim 26, directly or indirectly, and include all of its limitations. These dependent claims are allowable, at a minimum, for the same reasons discussed with regard to claim 26.

VIII. CONCLUSION.

The final rejection of claims of claims 15-34 should be reversed.

Respectfully submitted,

/Gary Peterson/
Gary Peterson, Reg. No. 28,891
211 N. Robinson Ave., Suite 450 South
Oklahoma City, Oklahoma 73102
(405) 606-3367

December 18, 2006 Attorney for Appellant

CLAIMS APPENDIX

15. An apparatus for welding a panel, comprising:

a welding area in which a flat panel framework having opposed first and second sides, each side having plural planar conductive surfaces, is horizontally positionable at a first welding position;

a first welding station situated in a first row within the welding area and positionable in contact with the first side of a panel framework in the first welding position, the first welding station comprising adjacent first and second electrodes of opposed polarity, each electrode having a planar contact surface adapted to contact a planar conductive surface of the first side; and

a second welding station situated in a second row within the welding area, longitudinally spaced from the first row, and positionable in contact with the second side of a panel framework in the first welding position, the second welding station comprising adjacent electrodes of opposed polarity.

16. The apparatus of claim 15, further comprising:

a conveyor capable of moving the panel framework horizontally within the welding area from a first welding position to a second welding position.

17. The apparatus of claim 15 in which the welding stations in the first and second rows are capable of welding simultaneously.

18. The apparatus of claim 15, further comprising;

a third welding station situated in a first row within the welding area and positionable adjacent the first side of a panel framework in the first welding position, the third welding station comprising adjacent electrodes of opposed polarity; and

a fourth welding station situated in the second row within the welding area, and positionable adjacent the second side of a panel framework in the first welding position, the fourth welding station comprising adjacent electrodes of opposed polarity.

19. The apparatus of claim 15, further comprising:

a panel framework situated within the welding area;

in which the panel framework is further characterized as comprising:

at least one channel-shaped first rail having a plurality of longitudinally spaced openings therein; and

a plurality of longitudinally spaced upright members, each upright member extending in transverse relationship to the at least one first rail, through the rail channel thereof, and through a corresponding opening therein.

20. The apparatus of claim 19 in which the rail is characterized as having a web with spaced side walls extending therefrom, and in which at least one of the side walls is characterized by a weld-forming region which projects within the rail channel.

21. The apparatus of claim 19 in which the panel framework further comprises:

a second channel-shaped rail, disposed in laterally spaced parallel relationship to the first rail;

in which each upright member extends in transverse relationship to the second rail, and within the rail channel thereof.

22. The apparatus of claim 19 in which the width of the first electrode is least about 75% of the width of the first rail.

23. The apparatus of claim 22 in which the width of the second electrode is at least about 75% of the width of an upright member.

24. The apparatus of claim 19 in which the width of the second electrode is at least about 75% of the width of an upright member.

25. The apparatus of claim 15 in which the first and second electrodes are characterized by a center-to-center separation of between about 2 and about 3 inches.

26. An apparatus for welding a panel, comprising:

a welding area in which a flat panel framework having opposed first and second sides is horizontally positionable at a first welding position;

a panel framework situated within the welding area, the panel framework comprising:

at least one channel-shaped first rail having a plurality of longitudinally spaced openings therein; and

a plurality of longitudinally spaced upright members, each upright member extending in transverse relationship to the at least one first rail, through the rail channel thereof, and through a corresponding opening therein; and

a first welding station situated in a first row within the welding area and positionable adjacent the first side of a panel framework in the first welding position, the first welding station comprising adjacent first and second electrodes of opposed polarity, the first electrode adapted to contact a first rail and the second electrode adapted to contact one of the upright members.

27. The apparatus of claim 26, further comprising:

a second welding station situated in a second row within the welding area, spaced from the first row, and positionable adjacent the second side of a

panel framework in the first welding position, the second welding station comprising adjacent electrodes of opposed polarity.

28. The apparatus of claim 26 in which the rail is characterized as having a web with spaced side walls extending therefrom, and in which at least one of the side walls is characterized by a weld-forming region which projects within the rail channel.

29. The apparatus of claim 26 in which the rail is characterized as having a web with spaced side walls extending therefrom, and in which each side wall is characterized by a weld-forming region which projects within the rail channel.

30. The apparatus of claim 26 in which the panel framework further comprises:

a second channel-shaped rail, disposed in laterally spaced parallel relationship to the first rail;

in which each upright member extends in transverse relationship to the second rail, and within the rail channel thereof, and in which the first welding station further comprises a third electrode adapted to contact the second rail.

31. The apparatus of claim 26 in which the width of the first electrode is least about 75% of the width of the first rail.

32. The apparatus of claim 26 in which the width of the second electrode is at least about 75% of the width of an upright member.

33. The apparatus of claim 26 in which the first and second electrodes are characterized by a center-to-center separation of between about 2 and about 3 inches.

34. The apparatus of claim 26, further comprising:

a conveyor capable of moving the panel framework horizontally within the welding area from a first welding position to a second welding position.

EVIDENCE APPENDIX

United States Patent [19]

Senn

[11] **3,780,253**

[45] **Dec. 18, 1973**

[54] **STRUCTURE FOR AND METHOD OF MESH WELDING**

[76] Inventor: **Charles Senn,** 12633 Wilfred, Detroit, Mich. 48213

[22] Filed: **Feb. 16, 1973**

[21] Appl. No.: **333,217**

[52] **U.S. Cl.** ..... **219/58,** 219/56, 219/87, 219/89, 219/117 R

[51] **Int. Cl.** **B23k 11/10**

[58] **Field of Search** 219/56, 58, 87, 89, 219/91, 116, 117, 119

[56] **References Cited**

UNITED STATES PATENTS

2,929,915	3/1960	Taylor et al.	219/87 X
3,463,895	8/1969	Senn	219/56
3,497,659	2/1970	Ritter et al.	219/58 X

Primary Examiner—Bruce A. Reynolds
Attorney—Dale R. Small

[57] **ABSTRACT**

A plurality of cylindrical welding guns for welding wire mesh in contact with each other staggered on each side of a linear transversely extending member of the wire mesh having off-center electrodes secured thereto with welding portions engageable with the wire mesh and insulated fixed electrodes positioned beneath the welding guns and wire mesh, which welding guns and electrodes secured thereto in conjunction with said fixed electrodes are adapted to produce welds at any of 2, 3, 4 and 6 inch spacing on simultaneous actuation of all of the welding guns through a single actuating media circuit having a single intake and a single outlet manifold, with all welding guns electrodes active as either welding electrodes or to provide a return circuit for welding electrodes during welding operations at all spacings, said welding guns beins constructed and arranged to permit location of all transformer structure therefor on one side of the welding guns without special clearance structure.

9 Claims, 6 Drawing Figures

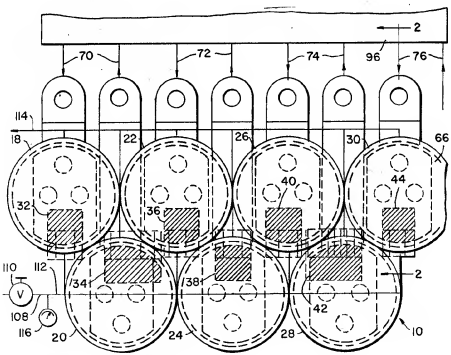
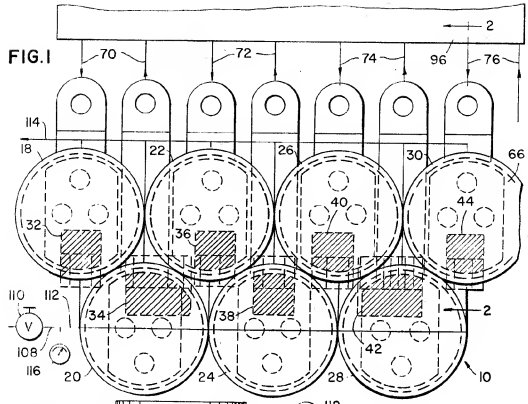


FIG.1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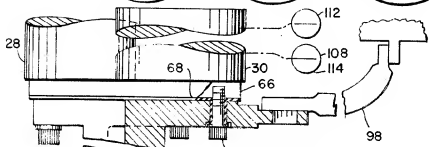
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FIG.2

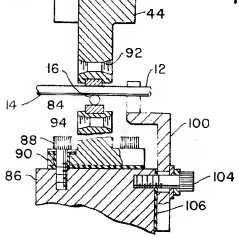
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FIG. 3A

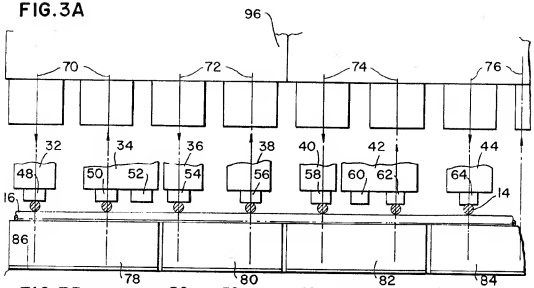


FIG. 3B

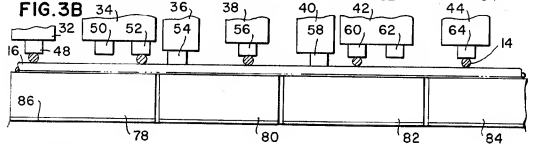


FIG. 3C

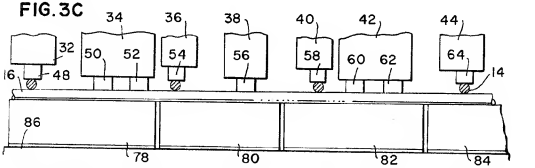
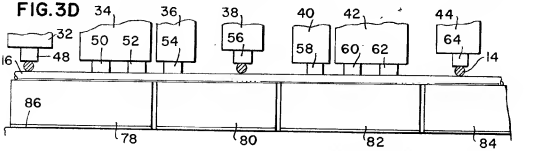


FIG. 3D



STRUCTURE FOR AND METHOD OF MESH WELDING

CROSS-REFERENCE TO RELATED APPLICATIONS

This application is related to previous U.S. Pat. Nos. 3,008,033 and 3,463,895 which are the closest known prior art relating to the present invention.

BACKGROUND OF THE INVENTION

1. Field of the Invention

The invention relates to welding guns and refers more specifically to apparatus for welding longitudinally extending linear members at selected spacing to transversely extending linear members to provide mesh for reinforcing concrete or the like using a plurality of known cylindrical welding guns arranged on one side of the mesh and all connected to be actuated through a single actuating circuit including a single inlet and outlet manifold while producing welds at a plurality of different spacings with each welding gun active during each weld and energized from the same side of the welding guns.

2. Description of the Prior Art

In the past, structure for producing longitudinally spaced apart welds on linear members such as wire for producing wire mesh to be used in reinforced concrete or the like have been particularly complicated. With prior structures, changing the spacing of the welds to produce mesh of different size has required down time of the welding structure of as much as 20 hours or more for each dimension change in the size of the mesh. Thus, change of size of mesh has been expensive in the past so that short runs of mesh of a particular size have not been accomplished economically.

The prior structure, as illustrated in U.S. Pat. No. 3,463,895, while a great improvement over the previous structures for welding wire mesh utilizing springs and the like, required separate manifold structure for each of the separate web spacings. Further, in the prior structure, all of the welding guns were not utilized during each weld at the different spacings. Also, welding guns were provided on opposite sides of the mesh and the transformer structure was connected to the welding guns on both sides of banks of welding guns.

SUMMARY OF THE INVENTION

In accordance with the present invention, there is provided an improved structure for and a method of welding longitudinally extending linear members at selected spacing to a transversely extending linear member, which welding may be repeated periodically to provide mesh for reinforcing concrete or the like. In the welding structure disclosed there is a bank of seven welding guns provided on one side of wire mesh to be welded which is repeated along each foot of the transversely extending linear member.

The welding guns are cylindrical, engage each other, and alternate welding guns are staggered on each side of the transversely extending linear member. Off-center electrodes are secured to each of the welding guns and include portions adapted to engage the linear members with the second and sixth electrode having two spaced apart portions engageable with the linear members at longitudinally spaced apart locations. The electrodes are engageable with the transversely extending linear member at the start of each foot thereof and at locations 2, 3, 4, 6, 8, 9, 10 and 12 inches from the start of each foot thereof.

Stationary electrodes are positioned beneath the welding guns on the opposite side of the mesh being produced for engagement with the electrodes on the welding guns through the linear members, with the first of the stationary electrodes being engageable with the electrodes on the first and second welding gun, the second stationary electrode being engageable with the electrodes on the third and fourth welding guns, the third stationary electrode being engageable with the electrodes on the fifth and sixth welding guns, and the fourth stationary electrode being engageable with the electrode on the seventh welding gun and providing a return electrical path for the electrical circuit through the electrode on the seventh welding gun.

A single pneumatic circuit including one inlet and one outlet manifold actuates all of the welding guns simultaneously during each weld, in accordance with the present invention, regardless of the weld spacing required. Further, all of the welding guns are active in each weld regardless of weld spacing to either provide welds or a return path for a welding circuit.

In addition, the welding guns are so constructed and arranged to permit mounting of all of the welding transformers for each of the seven welding guns on one side of the welding guns. Thus, access to the welding electrodes is facilitated.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a top view of a one-foot bank of welding apparatus constructed in accordance with the invention for performing the method of the invention.

FIG. 2 is a partial section view of the welding apparatus illustrated in FIG. 1.

FIGS. 3A, 3B, 3C and 3D are diagrammatic views of the welding apparatus illustrated in FIGS. 1 and 2 as used in 2, 3, 4 and 6 inch weld spacing, respectively.

DESCRIPTION OF THE PREFERRED EMBODIMENT

The welding apparatus bank 10 illustrated in FIG. 1 is suitable for welding a 1-foot width of wire mesh generally indicated 12 in FIG. 2 which includes the longitudinally extending wire members 14 and the transversely extending wire members 16. In producing reinforcing wire mesh for concrete and the like, a bank of welding apparatus 10 would be provided for each foot of width of the reinforcing mesh. Each bank would be a duplicate of the welding apparatus bank 10 so that only the first foot of the welding apparatus bank 10 is disclosed in detail herein.

The welding apparatus bank 10 as shown in FIG. 1 includes seven cylindrical welding guns 18, 20, 22, 24, 26, 28 and 30. The seven welding guns are the welding guns of previous U.S. Pat. No. 3,008,033 and include a stationary outer cylinder and piston and an inner cylinder which moves axially of the stationary outer cylinder between the outer cylinder and piston. With such structure, eccentric electrodes may be secured thereto without undue stress on and wear of the cylinders and piston of the welding gun structure to produce leakage and therefore early failure of the gun structure. The individual welding gun structure is set forth in detail in the above referenced patent, the disclosure of which is incorporaed herein by reference. The details of the

welding guns will not therefore be considered further herein.

As shown best in FIGS. 1 and 2, separate upper electrode members 32, 34, 36, 38, 40, 42 and 44 are secured to the respective welding guns 18, 20, 22, 24, 26, 28 and 30 by convenient means such as the bolts 46 shown best in FIG. 2. The electrodes 32, 36, 38, 40 and 44 are provided with single wire engaging portions 48, 54, 56, 58 and 64, respectively, engageable with the longitudinally extending linear members 14, as shown best in FIG. 3, at spaced apart locations along each transversely extending member. Each of the electrodes 34 and 42 have two wire engaging portions 50 and 52 and 60 and 62. All of the upper electrodes are eccentric with respect to the axis of the particular welding gun to which they are attached and are shaped generally as shown in FIG. 2 in transverse cross section. Also, the upper electrodes are insulated from the bolts 46 and the respective electrode mounting members 66 connected to the inner cylinder of each of the welding guns for movement therewith and are thus insulated from the welding guns to which the electrode mounting members 66 are secured by the insulating material 68, shown best in FIG. 2.

As shown best in FIG. 1, the welding guns 18, 20, 22, 24, 26, 28 and 30 of the welding apparatus bank 10 are staggered on opposite sides of a transversely extending linear member 16 and are in engagement with each other. The electrodes are offset sufficiently to place the wire engaging portions of the electrodes over the transversely extending linear members. Such positioning of the welding guns and offset construction and installation of the electrodes permits the welding apparatus bank 10 to be constructed in a minimum amount of space.

In accordance with the invention, the electrode mounting members 66 are shaped in plan view as shown in dotted lines in FIG. 1 whereby adjacent upper electrodes may all be terminated at one side of the welding guns, as shown particularly in FIG. 1. With such construction, the electrodes 34, 38 and 42 extend between the electrodes 32, 36, 40 and 44 with transverse clearance of for example one-eighth of an inch between adjacent electrode mounting members and electrodes.

Such construction permits mounting of all the electrical transformer structure 96 for supplying power to the welding guns 18, 20, 22, 24, 26, 28 and 30 on one side of the bank of welding apparatus 10 whereby easy access is permitted to the electrodes from one side of the welding guns. As shown best in FIG. 3, electrodes 32 and 34 form a first electrical circuit 70 with the linear members 14 and 16, electrodes 36 and 38 are connected together in a second electrical circuit 72, while electrodes 40 and 42 are connected in a third electrical circuit 74, and electrode 44 is connected in a fourth electrical circuit from the transformer structure 96.

The electrical circuits 70, 72, 74 and 76 are completed with the aid of four bottom stationary electrodes 78, 80, 82 and 84, respectively. Each of the bottom stationary elcctrodes is positioned on a bed 86, is secured thereto by bolts 88, and is insulated therefrom by insulating material 90. The electrodes 78, 80, 82 and 84, as shown best in FIGS. 2 and 3, support the transversely extending linear members 16 during welding thereof to the longitudinally extending linear members. Both the upper and lower electrodes may be cooled by fluid flow therethrough through the openings 92 and 94, respectively, provided therein.

As shown best in FIG. 2, the upper electrodes are connected to the transformer structure 96 for supplying electrical power to the welding guns through separate electrical cables 98 connected at the opposite ends to the upper electrodes and the transformer structure by convenient means such as bolts or the like (not shown).

As shown best in FIG. 2, guides for the linear members 14 and 16 such as the guide 100 may be secured to the bed 86 of the welding apparatus bank 10 by bolts 104 and insulated from the bed by insulating material 106. The guides 100 are provided as desired and are not themselves part of the present invention so that they will not be considered in detail herein.

It will further be noted that the apparatus for feeding both the longitudinal and transversely extending linear members are similarly not part of the present invention and are well known in the prior art so that they will not be considered in detail herein.

All of the welding guns 18, 20, 22, 24, 26, 28 and 30 are in accordance with the present invention actuated from a single pneumatic circuit 108. The circuit 108 includes an air pressure regulating valve 110 connected to a source of air under pressure (not shown), a single inlet manifold 112 is connected to each of the welding guns to apply air under regulated pressure such as eighty pounds per square inch to the top of the welding guns whereby a pressure of approximately 1,930 pounds is provided at the weld with a 19.3 square inch welding gun cylinder. Similarly, a single exhaust manifold 114 is provided connected to each of the cylinders for removal of air therefrom. An air gauge 116 is provided connected between the air pressure regulating valve 110 and the intake manifold 112 to indicate the air pressure applied to the welding guns on actuation thereof.

Thus, in operation, all of the welding guns 18, 20, 22, 24, 26, 28 and 30 are actuated under the same pressure and at the same time during each welding cycle regardless of the spacing of the wire mesh being welded. Further, each welding gun is active in each weld as will be considered subsequently in the overall operation of the welding apparatus bank 10.

In overall operation of the welding apparatus bank 10 and with particular reference to FIG. 3, the longitudinally extending and transversely extending linear members 14 and 16 are fed between the upper and lower electrodes in a known manner, as shown for example in FIGS. 3A, 3B, 3C and 3D, for wire mesh having 2, 3, 4 and 6 inch spacing, respectively. Air pressure is applied to the welding guns 18, 20, 22, 24, 26, 28 and 30 simultaneously through the single manifold 112 and all of the upper electrodes are caused to engage the longitudinally or transversely extending linear members in accordance with the diagrams 3A through 3D, whereby welding is effected in each of the separate circuits 70, 72, 74 and 76 connected to the transformer structure 96.

Wherein there is no longitudinally extending member, as for example beneath the wire engaging electrode portions 52 and 60 in FIG. 3A and beneath the electrode portions 54 and 58 in FIG. 3B, the upper electrodes continue downwardly until they contact the transversely extending linear member. Such upper electrodes act as return paths for the welding circuits.

Thus, in each welding circuit, with any of the 2, 3, 4 or 6 inch mesh spacing, as shown in FIGS. 3A through 3D, all welding guns are active.

With such operation, it will be noted that the additional movement of any upper electrode is only the thickness of one linear member of the wire mesh which is less than the thickness of the electrode mounting members 66. Therefore, no special structure is required to permit the extension of all of the upper electrodes to one side of the welding guns as shown in FIG. 1.

Thus, it will be understood that in accordance with the present invention there is provided a particularly simple, economical and efficient structure for welding wire mesh of 2, 3, 4 and 6 inch spacings in which welding guns are needed on only one side of the mesh and in which all electrical connections may be effected from one side of the welding guns. Further, in accordance with the invention, all guns are actuated during each welding cycle simultaneously through a single input and a single outlet manifold, and all welding guns are active in each welding cycle, either in effecting a weld or providing a return path for the welding circuit.

While one embodiment of the invention has been considered in detail, it will be understood that other embodiments and modifications thereof are contemplated by the inventor. Thus, it is not essential the activating media be air. It may be oil or the like. It is the intention to include all embodiments and modifications as are defined by the appended claims within the scope of the invention.

What I claim as my invention is:

1. Apparatus for welding longitudinally extending linear members at selected spacing to a transversely extending linear member such as in mesh for reinforcing concrete or the like, comprising a plurality of cylindrical welding guns positioned along a length of the transversely extending linear member staggered on each side of the transversely extending linear member, each of said guns being in contact with the immediately adjacent guns, upper electrodes secured to the welding guns positioned off-center of the welding guns over the transversely extending linear member, a plurality of stationary electrodes positioned beneath the welding guns along the transversely extending linear member, and a single means for simultaneously actuating all of the welding guns at the same time to bring all of the electrodes into engagement with either the longitudinally or transversely extending linear members whereby all of the welding guns are active during welds without regard to the spacing between adjacent parallel linear members.

2. Structure as set forth in claim 1, wherein the single means for actuating all of the welding guns at one time comprises a single manifold for passing an actuating medium into the welding guns and a single manifold for withdrawing an actuating medium therefrom.

3. Structure as set forth in claim 1, wherein all of the welding guns are positioned on one side of the mesh.

4. Structure as set forth in claim 3, wherein stationary electrodes are provided on the other side of the mesh, which stationary electrodes are insulated from their mounting structure.

5. Structure as set forth in claim 1, wherein transformers are provided for each separate welding gun to provide electrical energy therefor and all of the transformers are located on one side of the welding guns.

6. Structure as set forth in claim 1, wherein seven welding guns are positioned over each foot of the transversely extending linear member each having a separate electrode connected thereto and four stationary lower electrodes are provided extending along each foot of the transversely extending linear member and on the opposite side of the mesh from the welding guns.

7. Structure as set forth in claim 6, wherein the upper electrode secured to the first welding gun has a portion engageable with the linear members at the start of the foot of the transversely extending linear member, the upper electrode secured to the second welding gun includes separate portions enegageable with the transversely extending linear members at two and three inches from the first electrode portion, the upper electrode secured to the third welding gun has a portion engageable with the linear members at 4 inches from the portion of the first electrode, the upper electrode secured to the fourth welding gun has a portion engageable with the linear members at 6 inches from the portion of the first electrode, the electrode secured to the fifth welding gun has a portion engageable with the linear members at 8 inches from the portion of the first electrode, the electrode secured to the sixth welding gun has separate portions engageable with the linear members at 9 and 10 inches from the portion of the first electrode, and the electrode secured to the seventh welding gun has a portion engageable with the linear members 12 inches from the portion of the first electrode.

8. Structure as set forth in claim 6, wherein the first fixed electrode is positioned below the electrodes on the first and second welding guns, the second fixed electrode is positioned below the electrodes on the third and fourth welding guns, the third fixed electrode is positioned below the electrodes on the fifth and sixth welding guns, and the fourth fixed electrode is positioned below the electrode on the seventh welding gun and is connected to provide a return electrical path therefor.

9. The method of welding longitudinally extending linear members at selected spacing to a transversely extending linear member such as in mesh for reinforcing concrete or the like, comprising positioning a plurality of welding guns over the transversely extending linear member capable of producing welds at different spaced apart locations on the transversely extending linear member and actuating all of the welding guns simultaneously through a single inlet and a single outlet manifold in a single circuit for the actuating media therefor wherein all of the welding guns are active during each weld performed without regard to different weld spacing with the welding guns not actually producing a weld during each weld perpormed being used as a return electrical path for the welding guns actually producing welds.

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RELATED PROCEEDINGS APPENDIX

(none)